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## *He was one of the first to warn us the world was getting hotter*

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### **Body**

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NEW YORK CITY - In the autumn of 1969, a young doctoral student thumbs through a magazine published by his alma mater, the Massachusetts Institute of Technology. The Vietnam War is raging. Richard Nixon is president. The Manson killings have just horrified America with their Helter Skelter depravity.

But a different kind of headline blows Michael Oppenheimer's mind: "The Modification of Planet Earth by Man."

"Man's technology is changing the physical environment in ways which are not clearly understood," reads the introduction to the piece, by pioneering climate scientist Gordon MacDonald. "The results could endanger man's future on earth."

The article posits that the burning of fossil fuels and the resulting release of carbon dioxide into the atmosphere could be changing the planet - heating it up.

More than half a century later, Oppenheimer, now 75, says it was the first time he had considered that humankind was capable of environmental damage on such a vast scale, beyond nuclear war.

"For me, that was like a major mind-fuck," he said. "Of course, now the mind-fuck is, it actually happened."

That was the moment, he says, that began his slow metamorphosis from astrophysicist to environmental activist and ultimately one of the giants of climate science.

In his long decades as a scientist, he's offered guidance to titans of industry and to scores of graduate students at Princeton University. He's focused attention on how melting ice in the Antarctic threatens cities around the globe, advised the U.S. Congress and New York City on rising sea levels and tutored Margaret Thatcher on global warming.

Perhaps most significantly, he's worked with the United Nations' Intergovernmental Panel on Climate Change since 1990 and is one of the longest-serving report authors in the organization's history. In 2007, he and other IPCC contributors, alongside former U.S. Vice President Al Gore, were awarded the Nobel Peace Prize for their work highlighting the problem.

For all those triumphs, however, Oppenheimer and scientific seers like him have faced one resounding defeat: The world's political and policy leaders, supported by a large segment of the public in key fossil-fuel producers such as the United States and Australia, have been slow to act on their life's work, with some leaders staunchly resisting their findings of human-driven climate change.

It's been more than 30 years since Oppenheimer and fellow American climatologist James Hansen went before Congress to testify about their research. Humankind, they warned, was warming the planet through the burning of

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fossil fuels. In the years since, thousands upon thousands of scientists continued warning humanity. An unrelenting succession of their predictions proved correct. The early stages of the environmental disruption they foresaw are now felt worldwide.

Last year, parts of the Arctic Circle in Siberia approached 40 degrees Celsius, or more than 100 degrees Fahrenheit, and giant craters appeared in the thawing permafrost. So-called sunny-day flooding during lunar high tides is becoming common in many low-lying cities around the world. The forests of the West Coast of the United States have burned as never before, turning middays into ominous sunsets that rain ash.

Who are these scientists who have dedicated their lives to studying the climate, knowing that their work may go unheeded and do little to avert a climate catastrophe? And how do they deal with it?

This series focuses on six of those scientists, telling the stories of their lives, their research, their fears and hopes.

To identify the profession's biggest influencers, Reuters created the Hot List, a gauge of the clout of the top 1,000 researchers publishing scientific papers related to climate change. The methodology ranks climate academics according to how influential they are based on their output of papers about climate change, how often those papers are cited relative to others in their field, and how often those papers are referenced in the lay press, social media and other public policy studies.

Oppenheimer ranks 18th on the list. Hansen, who has come to be seen as a prophet by the media, ranks even higher: number 5. And yet despite their clout, they and their peers are Cassandras of climate change, their predictions often ignored.

Governments have taken some significant steps, of course. Many are pushing solar power and other Earth-friendly energy policies. Nations have banded together in a succession of landmark efforts to address climate change - from the creation of the IPCC in 1988 to the 2016 Paris Agreement on Climate Change, which focused on how to reduce carbon-dioxide emissions.

But the international pacts have little or no power to enforce emissions cuts. And support for more drastic action often has been undermined by everything from a hostile oil lobby to an often-indifferent public and the difficulties of switching from a fossil-fuel-powered economic engine to a renewable-powered one.

The arc of Oppenheimer's long career reveals the successes and failures of his quest to wake the world up to climate change. But while some of his peers might despair over the predicament the planet faces, Oppenheimer retains an arguably unscientific faith in finding a solution - even in the face of evidence that the political odds are against him. He seems allergic to discussions of doom.

"There's always the possibility that it won't be grappled with and we will suffer the consequences," he says. "I don't think we're headed there, but I can't prove it. That's where faith in humans and the human enterprise and personal optimism come into it, and neither of them is particularly rationally based. So don't push me."

## IN THE BEGINNING, OYSTERS

In the pre-pandemic world of 2019, Oppenheimer strolled into a neighborhood bistro near his home in Manhattan's West Village. The restaurant door closed behind him, muting the honking of cars. He took his place at his favorite table: in the corner, facing away from the bar and the entrance.

He glanced over the menu and considered starting his meal with oysters but then shifted to the snails.

"You think of them as seafood, but they're not, of course," he said of the escargots. "Where would I put eating escargot in the moral spectrum?"

The morality of eating certain kinds of food has only recently entered mainstream discussions of meals. But nearly 70 years ago, the perils of eating certain kinds of foods helped spark Oppenheimer's interest in the environment.

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His father ran a jewelry business for a man who lived on Long Island Sound, and the Oppenheims would often visit. It was a big stone house, with a stream on the grounds that ran down to the shoreline. During one visit, Oppenheimer discovered a bed of oysters.

"I must have been 6 or 7, going down there and playing in the creek. I was digging around and found all these oysters. I dug up more than a dozen and I carried them back to the house and I showed my mother."

Aghast, she made him throw them back, warning that he would get sick from eating shellfish because the water was so polluted.

"That stuck with me, and I blame that episode as one important reason why I became an environmentalist," he said.

Two decades later, he went through an adult ecological awakening. The same year he read about humans' ability to warm the planet, Oppenheimer and many other Americans were shocked by an oil spill in the ocean near Santa Barbara, Calif.

Activists' efforts to draw attention to the ecological damage of the spill helped lead to the first Earth Day on April 22, 1970, which saw millions of Americans demonstrating for environmental regulations. Oppenheimer spent Earth Day volunteering to teach elementary-school students on the north side of Chicago about the planet. In December, Nixon signed an executive order creating the Environmental Protection Agency.

Still, how to marry his scientific knowledge with his interest in the environment eluded him. So, in 1971, he took an astrophysics postdoctoral gig at Harvard's Smithsonian Center for Astrophysics.

"It was a five-year plan," he said.

But it led to a full-time research and teaching position, and for the next 10 years, he studied the gases in deep space. Through the 1970s, his career choice kept eating at him. In 1975, he won accolades after presenting a paper to NASA, the U.S. space program, on gases and the chemical processes in comets.

"It was very well received. And I walked out and got depressed because I realized that this was the best it was ever going to get as a research scientist," he said. "I had to do something that had some meaning beyond just the science."

In 1981, he finally quit Harvard. "What do I give a shit about what happens in space? We've got some bad stuff happening on Earth."

He followed his heart to the Environmental Defense Fund, an organization that was combining hard science with political advocacy to shape U.S. policy. The EDF had already spearheaded the successful battle against the pesticide DDT in the 1960s and played an important role in the passage of the Safe Drinking Water Act of 1974.

Rafe Pomerance, a veteran leader of the climate-change movement, said Oppenheimer was a significant addition to the EDF ranks.

"I thought it was a brilliant hire by EDF at the time," Pomerance said. "He was a first-rate atmospheric scientist. He knew these issues in depth. He was credible. He could understand the details of any scientific paper. And yet is actually one of those few people able to bridge the science policy, science media world very well."

"He turned that into human language. He was an extremely important addition to the community."

Oppenheimer began at EDF by focusing on the causes of acid rain and fighting for legislation to reduce emissions from burning coal. When sulfur dioxide and nitrogen oxides in the coal smoke combine with water in the atmosphere, it creates sulfuric and nitric acids, a corrosive compound that came back to Earth in rainwater.

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The acid-rain puzzle turned out to be a first-cousin issue to climate change. Scientists determined that warming, too, was being driven by gases in the atmosphere: the emissions of carbon dioxide and other byproducts of fossil fuel use. That work propelled his career from academic research scientist to scientist-activist at EDF.

"I understood the science better than anyone employed in the environmental activist community," Oppenheimer said, "because it aligned with my previous research."

In 1990, in part because of Oppenheimer's work, the U.S. Congress amended the 1970 Clean Air Act, adding regulations that forced coal-burning facilities to remove sulfur dioxide and nitrogen oxides from their smoke.

"I learned an enormous amount from the inside about how the political process works, including the value of and the limits of science in the policy process," Oppenheimer said.

He discovered something else: "I learned that focused effort over nine years by motivated people can cause big changes."

#### A DAY WITH MARGARET THATCHER

Since 1976, Oppenheimer and his family have summered in their rustic two-story farmhouse on Block Island off the coast of Rhode Island. For the scientist, it's the place where he can commune with the boy who harvested shellfish from Long Island Sound.

A wallet-sized picture hangs on the fridge, taken shortly after he and Leonie, then his girlfriend, her mother and her two siblings pooled their money to buy the house. He's wearing his wiry, dark hair long and has a scruffy beard with a muscular mustache. He looks more of a Greenwich Village folk singer than the scientist he was.

He's balding now, though he sometimes still wears the same mustache. He and Leonie have been married since 1986, and they have a son and a daughter. His mother-in-law died in 2008, but her easel still stands in her bedroom and her paintings hang all over the house.

In the summer of 2019 and 2020, I visited Oppenheimer on Block Island to chat about his life, his career and the future of the planet.

On one visit, before dipping into the waves at a nearby beach for his daily swim, he pointed toward a wave-shaped dent carved into a bluff made of sand and clay.

"That's probably what sea-level rise will look like here," he said.

One evening, Leonie encouraged Oppenheimer to tell his "Maggie Thatcher" story.

The mid-1980s and early 1990s were a time of rising profile for climate scientists and for Oppenheimer. By that time, while still working at EDF, he had gradually shifted his gaze from acid rain to climate change, and then focused on sea-level rise and related issues such as the melting of Antarctic ice.

In particular, he started focusing on the risk posed by rising sea levels should global warming cause the West Antarctic ice sheet to disintegrate. If the entire sheet were to melt, for example, sea levels would rise by about 10 to 12 feet. Even if there is a substantial reduction in carbon-dioxide emissions and most of the ice sheet remains intact, sea levels are still expected to rise by a couple of feet by 2100.

"My most important finding was that the risk of ice sheet disintegration implied a climate 'danger zone' around 2 degrees Celsius, and this could help define climate policy in answer to the ultimate issue: How warm is too warm?"

In April 1989, British Prime Minister Thatcher invited him and about 25 other scientists to 10 Downing Street to brief her and her Cabinet on the emerging research. Thatcher herself was trained in science - she had majored in chemistry at Oxford University before turning to the law.

The meeting started at 9:30 in the morning and went until 3:30 that afternoon.

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"Margaret Thatcher spent all day on this briefing," Oppenheimer recalled. "She was there listening to scientists mumble on in their incomprehensible and frequently undistinguished way. She was engaged. She was focused. She made her cabinet sit there through the whole thing."

During a coffee break, he said, Thatcher mingled in the room, chatting with the scientists about their work.

"I said, 'You know, it's great that you're doing this. No American president would pay attention to an issue like this.'"

Before she left office a year later, Thatcher had championed several scientific initiatives, including the formation of the U.N. Framework Convention on Climate Change in 1992.

Former Thatcher speechwriter and cabinet member John Gummer said the prime minister played an important role in persuading a skeptical U.S. President George H.W. Bush, a Texas oilman, to go along.

Despite Bush's support, the 1980s and 1990s saw opposition to the emerging climate research coalesce on the political right in America. And Thatcher eventually did a U-turn. In her 2002 memoir, she renounced her support for the Kyoto Accord, under which the world's nations agreed to try to limit emissions of carbon dioxide and other gases from fossil fuel use, in part by employing a carbon-emissions trading system that the European nations and China still use.

"The doomsters' favorite subject today is climate change," she wrote. "It provides a marvelous excuse for worldwide, supra-national socialism."

President Bill Clinton, a Democrat, signed the Kyoto treaty but didn't send it to the Senate for ratification; it wouldn't have passed in the Republican-controlled Senate.

Christine Todd Whitman, a Republican, served as head of the Environmental Protection Agency under the next president, George W. Bush, like his father a Texas oilman. She said Republican presidents since Ronald Reagan in the 1980s through Donald Trump have fought science and related regulations that threatened the oil industry and other business interests aligned with the party.

"Republicans were turning away from the science, as it was telling them stuff they didn't want to hear about climate change," she said.

The American Petroleum Institute, the oil-and-gas producers lobby, declined to discuss any role the industry may have played in trying to discredit climate science. Aaron Padilla, the API's manager of climate policy, said the industry is committed to finding solutions to climate change.

"As an industry, we have established clear principles focused on advancing innovative solutions for a cleaner future and supporting efforts like the IPCC to increase our understanding of global climate change," he said in a statement.

Hansen says oil companies and other resisters of scientists' message skillfully waged a war of semantics on the issue. A central battle took place over the word "uncertainty," a key term in describing the state of knowledge in any science. For climate scientists, the word has been used to express a range of possible outcomes flowing from their findings, from the serious to the catastrophic. Oil companies, Hansen says, have used the word to suggest that scientists are "uncertain" about the human cause of global warming. They are not.

Katharine Hayhoe, who will take over as chief scientist for the Nature Conservancy in June, said there is a disconnect between the "abstract minds" of typical scientists and the "concrete minds" of the public. In her view, the opponents of climate change research understand and exploit that disconnect.

In February 2015, for example, U.S. Senator James Inhofe, a Republican from the oil-producing state of Oklahoma, took a snowball onto the floor of the Senate to cast doubt about global warming. While intellectuals were worrying about climate change, Washington was so cold that day that it snowed - proof, Inhofe said, that climate change is bunk. Inhofe's stunt was mocked in the press, but Hayhoe says it was powerful theater, concrete and easy to grasp.

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"We scientists say the climate is changing over a decade, and then a senator brings a snowball onto the floor of the Senate and says, 'Look at this snowball, where's global warming now?'"

Inhofe's staff didn't respond to requests for comments regarding the incident and his views of climate change.

Scientists, Hayhoe says, aren't doing a good job of getting their message across to the lay world. Hayhoe, ranked 301st on the Reuters Hot List, believes scientists should connect with small groups of people with whom they share interests - church, hobbies - to discuss how climate change is directly affecting their own community.

"I feel that where I can contribute the most is reaching individual people who can then speak to their elected representatives and let them know that, even though they may be conservative or even though they may live in Texas, that they want their leaders to support climate policy."

Hansen says the message is also clouded by the cheapness of oil, which enjoys generous subsidies from the U.S. and other governments. The global climate pacts, he says, "are wishful thinking. As long as fossil fuels are allowed to be the cheapest energy, then people are going to keep burning them."

Sitting on the edge of his porch on Block Island, Oppenheimer attributed the inaction on science's message to something more elemental.

"Things haven't been painful enough for enough of the big countries to make them put the climate as a priority above almost anything else," he said. "Eventually it is such a serious risk that they have to make it a top priority."

## PREDICTING A GRIM FUTURE

On Avenue Princess Grace near the Grimaldi Forum convention center in the wealthy seaside principality of Monaco, luxury-car dealerships are strung like high-octane pearls: Lamborghini, Aston Martin, Ferrari, Rolls-Royce. Inside the convention center, Oppenheimer and other climate scientists gathered one day in the fall of 2019 to shepherd the latest IPCC report past a gauntlet of 195 country representatives.

The chapter on melting polar ice and rising sea levels around the planet was Oppenheimer's swan song after nearly 30 years as an author on various reports. The final report was 677 pages long. All of the countries had to work their way through every page before the gathering. Now they had to agree on every word in the 36-page "Summary for Policymakers."

The summary highlights the most pressing science in any IPCC report and is usually the most contentious. In Monaco, as always, everyone in the room had to sign off on every word, sentence and paragraph, every number, chart and graph. That's how the IPCC works: by consensus.

In contrast with years past, most of the oil-exporting countries stayed quiet at the Monaco meeting - in part, Oppenheimer said, because even countries such as Saudi Arabia can no longer ignore what carbon dioxide is doing to the planet.

But the Saudis did force the cancellation of an extra evening session in Monaco because the meeting chair hadn't followed the correct procedure in scheduling the session, he said.

"That was a statement by them that 'we are to be reckoned with, even though we haven't been complaining much,'" Oppenheimer said.

The Monaco gathering, however, was a marked change from the early days of the IPCC. The 1995 Madrid session, where the IPCC prepared its Second Assessment Report, was particularly contentious, with the Saudis playing a key resistance role, he remembered.

"They disrupted the proceeding, caused endless argument over small points, and forced the entire Summary for Policymakers to be rewritten, somewhat diluting it," Oppenheimer said. "However, the key sentence remained, the

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first statement by IPCC attributing warming to greenhouse gases from human activity - a discernible influence on global climate."

In 1995, Jonathan Pershing was at the U.S. State Department and a member of Washington's IPCC delegation. Pershing recalls the Saudis raising alternate scientific theories, such as periods of active solar sunspots, to explain climate change. "And none of them were compelling," Pershing said. "But all of them were raised, creating this difficulty for the community to say, 'We dismiss your concern and move on.' That was what they were able to do, delay the process."

Asked about the kingdom's role in the IPCC, Saudi officials said they were never obstructionist and they don't dispute the consensus science that climate change is caused by the use of fossil fuels. But, they added, the kingdom believes the response to climate change must be grounded in practical solutions that allow for a slow retreat from an oil-dominated economy while the country develops alternate energy sources. A sudden shift would risk political instability. They also believe that the developed nations responsible for the bulk of carbon emissions should bear the brunt of solving the climate challenge.

In 2014, at the IPCC meeting in Copenhagen, came another pivotal moment. It turned on a proposed two-page "box" in the Fifth Assessment Report. This short companion article explored the dangerous consequences of global temperatures rising by more than 2 degrees and the emission reductions needed to avoid that threshold.

For the oil producers, it went too far, said Jean-Pascal van Ypersele, a Belgian climatologist and former vice chair of the IPCC. For developing-world representatives, it didn't go far enough. They wanted the box to spell out the threat they faced and recognition they would need help, he said.

In the end, the entire item was nixed. Oppenheimer and Van Ypersele, its primary champion, were crushed.

Oppenheimer, however, said the missing sidebar had a second life. The idea blossomed over the coming years, in talks leading up to the Paris agreement, into a 2018 special report. That project examined what was needed to keep Earth's average temperature from rising more than 1.5 degrees Celsius - and the consequences of missing that target and temperatures rising 2 degrees. Instead of a two-page box, it spanned more than 500 pages.

"Ironically, removal of that box left a hole that was a factor, I believe, in delegates calling for the 1.5-degree report. That report wound up getting far more attention than the box would have - boomerang!"

The IPCC has its critics, and not just those who don't believe in human-driven climate change. Some scientists say the reports lag the latest research and tend to understate the risks the planet faces. Others complain that the consensus model gives too much power to individual countries, such as oil producers, whose interests don't align with the rest of the world.

Oppenheimer acknowledges all that. But he says the urgency of recent scientific findings means the reports are getting sharper. Over the years, the IPCC's work has become increasingly dour as the staggering volume of science behind climate change has grown.

In Monaco, there was little watering down, and the final report made for grim reading: By the end of this century, for example, if carbon-dioxide levels increase unabated, the seas may rise by more than a meter, periodically inundating parts of many of the world's major coastal cities - Los Angeles, Miami, Bangkok, Manila. Even if carbon-dioxide emissions are drastically reduced soon, seas will likely routinely flood those cities by 2100, according to the report.

That's the problem the planet faces, Oppenheimer explained: So much of the disruption we face may already be baked in. And the longer we put off tackling the problem, those baked-in consequences get worse.

"An honest policymaker, who is not thinking about his political future and wants to do an honest job, wants to know what's the worst case that could happen," he said. "And even if they're only worried about being re-elected, he doesn't want to get on the wrong side, in case something bad happens in his tenure."

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Despite the political resistance to the science, Oppenheimer says he's undaunted. He cites what's happened to the air and water near his native New York, thanks in large part to the 1972 Clean Water Act and the Clean Air Act. Today, oysters are routinely harvested in the Sound. The Hudson River is cleaner than it has been in generations.

It's this kind of progress, Oppenheimer says, that supports his optimism about the power of science to effect a lasting change in the environment.

Over the decades of a long career, he has witnessed scientists' terrible predictions come true. But he's not giving up.

"Why? Because it's personal."

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## Classification

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